

Analysis of Six Columbia Records, Received
from Mr. Holden, and Marked With His Initials and My Own for
identification.

The records were cut off, leaving about one inch
on the label end, and the balance is ground in mortar to fine
powder, thoroughly mixed and labeled "Columbia Composition".

For purposes of comparison a sample from six Edison
records made from the composition specified in patent No.
182,375, was prepared in like manner and labeled "Edison Com-
position".

PHYSICAL TESTS.

Melting point	- Edison Composition	- 117°C.
" "	- Columbia "	- 126°C.
Specific Gravity	- Edison "	- 1,011
" "	- Columbia "	- 1,010

CHEMICAL ANALYSIS

Inorganic contents.

Edison Comp.	3.154 per cent	Na ₂ O (Sodium Oxide)
Columbia "	3.795 per cent	" " "
Edison "	.554 per cent	Fe ₂ O ₃ and Al ₂ O ₃ (Iron & Alum.)
Columbia "	.694 per cent	" " " "

The iron is a very small part of the above figures
and in the case of the Columbia Composition there was barely
enough to color the precipitate of alumina. There was no
appreciable amount of any other inorganic substance, excepting
very small amounts of Silica and Lime, which most probably
came as impurities in some of the ingredients.

TOTAL INORGANIC SUBSTANCE

Edison Composition	-	95.96 per cent
Columbia "	-	95.09 per cent

ANALYSIS OF THE ORGANIC SUBSTANCE

	<u>Edison</u>	<u>Columbia</u>
Total fatty acids	75.06 per cent	76.11 per cent
Hydro carbon & fatty alcohols	19.07 "	17.78 "

ANALYSIS OF THE FATTY ACIDS

	<u>Edison</u>	<u>Columbia</u>
Stearic, Palmitic & Oleic	67.66 per cent	74.07 per cent
Cerotic Acid,	7.40 " "	2.40 " "

The identity of the cerotic acid was determined by its melting point (79°C.), its solubility in hot ethyl alcohol with almost complete separation on cooling; and its moderate ^{molecular} weight (396).

ANALYSIS OF THE FATTY ALCOHOL & HYDRO CARBON MIXTURES

	<u>Edison</u>	<u>Columbia</u>
Myricyl Alcohol	6.72 per cent	3.5 per cent
Hydro carbon	12.98 "	14.28 "

The identity of the myricyl alcohol was determined by its reaction with soda lime at 490 degrees F. whereby hydrogen is evolved and melissitate of soda and lime are formed. The melissic acid being separated from the lime and soda, was identified by its high melting point (which in the unpurified condition was 86.°C.) the pure acid melting at 90°C. Also, by its crystalline appearance and its solubility in hot alcohol and almost complete separation on cooling, and by its molecular weight (452). This latter is determined by measuring the amount of the Na₂O necessary to exactly neutralize a given

weight of the acid substance. The identity of the hydro carbons could not be determined with certainty without a very long series of experiments, but those obtained, from the Columbia composition appear to be a mixture of ceresin and paraffine.

ANALYSIS TO DETERMINE STATE OF COMBINATION OF THE
ALCOHOLS AND FATTY ACIDS.

	<u>Edison</u>	<u>Columbia</u>
Fatty acids, free & combined) with Soda and alumina)	64.59 per cent	71.48 per cent
Fatty acids combined as) compound ethers)	10.47 "	4.63 "

These results were obtained by acting on an equal weight of two portions of the wax as follows:-

One portion is decomposed by dilute hydrochloric acid, which extracts the mineral contents and liberates the fatty acids therefrom, but has no action on the compound ether.

The other portion is first completely saponified by a strong solution of potash in methyl alcohol (which decomposes all compound ethers and liberates the fatty alcohols therefrom), and subsequent decomposition by dilute hydrochloric acid, which liberates all the fatty acids contained.

The difference between the total fatty acids and the fatty acids obtained without decomposition of the ethers, represents the fatty acids combined as ether.

Of these fatty acids combined as ethers, a separation was made which resulted as follows:

	<u>Edison</u>	<u>Columbia</u>
Fatty acids melting at 59°	5.1 per cent	3.9 per cent
Cerotic acid	5.37 "	1.73 "

Now since these lower fatty acids having melting point at 59°C. do not occur to an appreciable extent in carnauba wax, it is evident that a reaction takes place during the manufacture of the wax, whereby the free myricyl alcohol of the carnauba wax combines with the free fatty acids of the composition to produce compound ethers which previously did not exist in any of the ingredients.

Summing up this analysis, I would conclude that the composition of the Columbia Compound closely approximate the following:

Na ₂ O	3.8 per cent
Al ₂ O ₃	.7 "
Stearic acid of commerce	71.7 "
Carnauba wax	7.8 "
Ceresin and paraffine	14.3 "
Black pigment	small per cent
(Nature not definitely determined)	

(Signed) J.W. Aylsworth.

Composition - Edison patent

100 Stearic	68 per cent
21.3 Carnauba	14.49 "
21.3 Ceresin	14.49
21.5 Carbonate Soda)	
1.0 Caustic ")	4.81 "
Aluminum	.382 "
Lamp Black	.61

Composition - Edison Record

- 66.8 per cent Stearic	
- 14.87 "	Carnauba
- 12.98 "	Hydrocarbon
- 3.15 "	
- .56 "	
(Al. 2O ₃ of .303 al.)	